September-October 1990

FAA Aviation NEWS

A DOT / FAA FLIGHT STANDARDS SAFETY PUBLICATION

Special Training Issue

Past, Present, and Future

U.S. Department of Transportation
Federal Aviation Administration

FAA Aviation NEWS

September/October 1990
Volume 29 Number 5

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FAA AVIATION NEWS is published by Flight Standards' Accident Prevention Program Branch, AFS-20, Federal Aviation Administration, Department of Transportation, Washington, DC 20591, in the interest of flight safety. The magazine is designed to promote safety in the air by calling the attention of general aviation airmen to current technical, regulatory, and procedural matters affecting the safe operation of aircraft. Use of funds for printing FAA AVIATION NEWS was approved by the Office of Management and Budget. All printed materials contained herein are advisory or informational in nature and should not be construed as having regulatory effect. The FAA does not officially endorse any goods, services, materials, or products of manufacturers that may be mentioned. **Certain details of accidents described herein are altered to protect the privacy of those involved.**

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BRIEFS

HAPPY LANDINGS...and to all a good flight. I am bailing out after 25 years at the helm of this magazine. I thank one and all for being such a loyal, appreciative, and forbearing audience. Whatever else you do, keep the sky a place where magic happens.
– David Gelfan, Editor

SEND NO CASH. Some airmen are contributing to the delays the FAA has grading and returning written test results. They are sending money to the FAA in Oklahoma City requesting their written test grades be returned via express mail or one of the other overnight delivery services. Because the FAA only uses first class mail for mailing test results, their requests can not be complied with. However, these requests are adding to the current 45-day test processing delay because of the time and effort required to return the money.

One way applicants can get their test results immediately is by using one of the 66 FAA approved national computerized test centers operated by the Plato Professional Development Centers. See page 13 of this issue for details about the test program.

AIRPORT IMPROVEMENTS. The FAA approved $766,192,813 for airport improvements during the third quarter of Fiscal Year 1990. The money, from the Aviation Trust Fund, went for 370 projects in 49 states and three territories. Of that amount, $50,214,045 was allocated for 113 projects at general aviation airports. More than $32 million was approved for 47 projects at reliever airports, while primary and smaller commercial airports received more than $680 million.

MODE C TRANSPONDER REQUIREMENTS. Effective December 30, 1990, all aircraft operating within the airspace of an airport radar service area (ARSA) and within the airspace above the ceiling and within the lateral bounderies of an ARSA upward to 10,000 feet MSL must be equipped with an operable transponder with automatic altitude reporting capability, Mode C.

The New Reality of Aviation Training

A Challenge for Now and the Future

by John S. Kern

The training and continuing education of civil aviation airmen—pilots, aircrews, maintenance technicians, air traffic controllers, and instructors—is the most complex and perhaps the predominant aviation safety issue of this decade. FAA and the aviation industry have become concerned about the future availability of fully qualified pilots, maintenance technicians, and other skilled employees needed to perform tasks of an increasingly sophisticated nature.

The recent growth in the general aviation population has not been nearly so spectacular, but general aviation remains a very important segment of the industry and a continuing source of candidates for the air carriers. It has been apparent for some time that adjustments to the standards for training general aviation airmen and maintenance technicians have not kept pace with the rapid advances in aircraft technology and the modifications of the airspace system. Since the last major revisions to Federal Aviation Regulations Part 61 (Certification) and Part 141 (Training Schools), we have found it necessary to enact 22 regulatory amendments and to issue 3,585 exemptions to these rules. In addition to the number of amendments and exemptions, recommendations and comments from the National Transportation Safety Board, the public, and local aviation authorities have also pointed up the disparity between the rules and today's flight environment.

As a result, in 1987 the FAA began a systematic review of Parts 61, 141, and 143 (Ground Instruction). We separated this review into three categories: issues of immediate concern, current operational requirements, and future requirements for the year 2010 and beyond. Following public hearings and further review, a proposed rule relating to immediate needs and amending Parts 61 and 141 was published in the spring of 1989. The final rule on these subjects will be published later this year.

Additionally, FAA will issue a proposed new rule, Part 142, regarding certificating simulator training centers for other than air carrier certificate holders.

On the air carrier side, FAA will issue a Special Federal Aviation Regulation (SFAR 58) establishing a voluntary alternative method of training, evaluating, certificating, and qualifying personnel who operate air carriers under FAR Parts 121 and 135. SFAR 58 will apply to all flight crewmembers, flight attendants, aircraft dispatches, instructors, evaluators, and other operations persons.

This new training method, developed by FAA in response to recommendations of a joint FAA/industry task force established in 1987, is called the Advanced Qualification Program, or AQP. SFAR 58 will allow a Part 121 or Part 135 certificate holder to depart from the training standards, which have been in existence for many years, to take advantage of the most advanced training techniques now available.

In contrast to current rules which require a given number of hours at fixed intervals for basic training or retraining, the AQP requires an instructional program in which trainees must attain a specified degree of proficiency before being qualified or recertificated. This could involve more or less hours than required in the current curriculum.

Powered by ultra high bypass turbo-prop fan engines, this Boeing 727-100 flew at speeds of 300 knots and at altitudes of 21,000 feet during its test flight.

AQP also requires that each make, model, and series of aircraft have its own curriculum for the various operational personnel involved. In addition, each curriculum will include data collection procedures which will enable FAA to determine whether the overall training objectives are being met.

In the air carrier segment of aviation it is apparent that the aircrews' increasingly sophisticated equipment and the regulatory environment they fly in is placing a heavy demand on FAA's ability to insure adequate selection, training, and currency programs for the airman. Part of the problem is the air carrier industry's unprecedented growth. According to trade publications, total airline hiring in the first six months of 1990 included more than 4,500 pilots, 5,500 aviation maintenance technicians, and nearly 9,000 flight attendants.

In order to accommodate the anticipated growth in air traffic with the same or improved high level of flight safety, we are continuously improving our National Airspace System (NAS) equipment with ultramodern, state-of-the-art electronics. Traffic Alert and Collision Avoidance Systems (TCAS II) are rapidly being installed in the airline fleet. Digital instrumentation, fly-by-wire controls, advanced turbo-prop fan engines, and many other efficiency or safety related devices are already here or on the horizon.

Despite the high degree of cockpit sophistication present in modern air carriers we are still seeing accidents happen that should not have happened. We are seeing air carriers crash with tragic loss of life, because they are not properly configured for the phase and conditions of flight, or for lack of appropriate crewmember coordination. We have even seen some evidence of alcoholism in the cockpit of major carriers.

A careful review of recent air carrier accidents indicates that the major cause is not equipment failure or external conditions. It is because of a tendency of human beings to behave, under certain circumstances, in a manner which in effect overrides all of the electro-mechanical devices we have installed to provide maximum safety. This is the so-called "human factors" element. To deal with it, we are including Cockpit Resource Management training in AQP. We are also in the final stages of development of a National Plan for Aviation Human Factors. This plan will identify operationally significant human performance issues. We will then allocate national resources to conduct research or other activities to improve human performance.

The intent of AQP is to enable operators to train personnel to a level higher than that currently provided by Parts 121 and 135, without unduly increasing the cost of training. The emphasis will be on demonstrated proficiency, rather than on hours or frequency of training. Some additional training costs are anticipated, especially as the program is initiated, but the payoff in terms of increased safety should more than compensate for this. Using an AQP is not, in any case, mandatory.

After considering all comments received on the proposed rule, FAA will publish SFAR 58 as a final rule within the next several months. An advisory circular (AC 120-AQP), explaining AQP in detail, will be published shortly thereafter. Although SFAR 58 applies only to Parts 121 and 135 operators, it has implications that may also be applied to other operators, including general aviation, in the future.

Two sections of the newly formed FAA Air Carrier Training Branch, AFS-210, are located at Dulles Airport near Washington, DC, and will review and administer the AQP. This branch, with its Washington, DC, units, will work to standardize air carrier training throughout the nation and to keep the public informed on these matters. Requests for approval of AQP operator applications will be handled through local principle operations inspectors.

Information on how to obtain copies of both the new aircraft carrier rule and the general aviation rule, as well as FAA advisory circulars associated with them, will be published in an upcoming issue of this magazine. As concerned aviation enthusiasts I urge you to study the following articles in this issue, which will afford you a preview of some very important rule changes to come. ■

EDITOR'S NOTE: Mr. Kern is Deputy Associate Administrator for Regulations and Certification.

Updating the Airman's Certification "Bible"

Regulatory Review of FAR Parts 61, 141, and 143

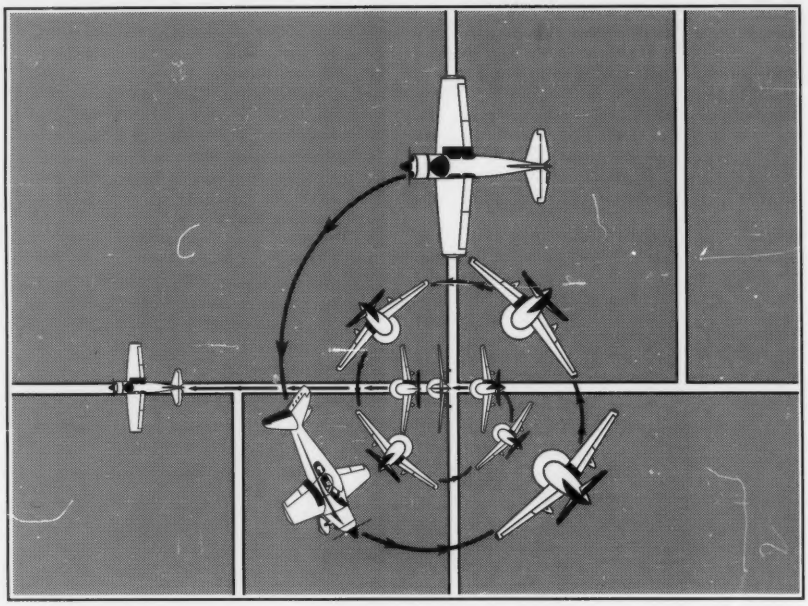
The FAA's last major look at pilot and instructor training and certification was nearly 20 years ago. The Federal Aviation Regulations revised or enacted from that review, Parts 61, 141, and 143, have stood up well over the years, but rapidly changing technology, new training initiatives, and the increasingly complex airspace system all pointed to the need for updating the regulations. As a result, the FAA and over 400 volunteers from the aviation community recently completed a thorough job task analysis designed to address immediate safety needs, areas that require more study, and future needs and developments.

The review's first phase began with a historical review of the current regulations, including exemption activity, petitions for rulemaking, and letters from the public. Also considered were comments from two public hearings and input from a number of universities and fixed-base operators involved in flight training. Based in part on the hearings, as well as recommendations from the National Transportation Safety Board, the FAA published a notice of proposed rulemaking on May 26, 1989.

The amendments to FAR Part 61, scheduled to be published this fall, are a response to the need for additional training for certain flight conditions to increase flight safety. The new rules will establish the following training requirements:

- Tailwheel Airplanes: Require pilots who do not have PIC experience in tailwheel airplanes to obtain flight training and an endorsement from an instructor.
- Flight Review: Permit completion of one or more phases of the Pilot Proficiency Award ("Wings") Program to satisfy the biennial (BFR) or annual (AFR) flight review requirements.
- Airplanes Requiring a Type Rating: Require an applicant to have completed ground and flight training on the maneuvers and procedures in FAR Part 61, Appendix A, or require an applicant to have completed a course of training under FAR Part 121, 135, or 141.
- High Altitude Training for Pressurized Airplanes: Require training on the aerodynamics, meteorology, and physiology of high altitude flight for pilots qualifying in pressurized airplanes that have a service ceiling or maximum operating altitude about 25,000' MSL.

- Stall/Spin Awareness Training: Increase emphasis in ground training on stall awareness, spin entry, spins, and spin recovery techniques; require training in "slow flight" with realistic distractions to simulate typical stall/spin hazard situations.
- Instructor Spin Demonstration: Clarify in the rules that instructor applicants must receive an endorsement for spin training and that examiners may require a spin demonstration on initial practical tests or accept the spin endorsement; require a spin demonstration on retest if applicant failed the oral, or flight, stall or spin portion of the practical test.
- Chief/Assistant Chief Flight Instructors: For chief instructors, remove the 100-hour recent instruction eligibility requirement; for assistant chief instructors, reduce total flight and instruction eligibility time to one-half that of the chief instructor.
- Pilot Schools: Clarify the availability of chief/assistant chief instructors; permit satellite bases more than 25 miles from main base; require a designated assistant chief instructor at all satellite bases.
- "Clean Up" Items: Remove references to gender in the rules; delete obsolete dates.



In the preparation of these rule changes FAA conducted a comparative study of tailwheel airplane versus tricycle gear airplane accidents during takeoff, landing, and taxiing. FAA estimated that for the year 1988 tailwheel airplanes comprised about 19 percent of the total active general aviation piston-powered fleet—about 37,000 such aircraft compared with approximately 155,000 tricycle gear airplanes, including retractables. For the three segments of flight mentioned the tailwheel airplanes accounted for 26 to 29 percent of the accidents, considerably out of proportion to the numbers of aircraft.

It is not expected that the tailwheel training amendment will impose a significant financial burden on pilots. Most owners who rent out their tailwheel airplanes, or companies that issue insurance policies on them, already require an adequate checkout for a pilot without previous experience in the airplane. Pilots who have logged pilot-in-command time in tailwheel airplanes before the effective date of this rule are excepted from the requirement. There is no requirement for completing a flight review in a tailwheel airplane.

Final rule changes to FAR §141.35 and §141.85(b) clarify the required availability of the chief or assistant chief instructor during flight training. Availability of these persons is defined as being reachable by telephone or radio. The chief instructor's physical presence is not regarded as essential at all times, since the chief instructor's role is regarded as supervisory in nature. The existing rule concerning the 24-nautical mile limit on the distance between satellite flight training bases and the main operating base will be eliminated. An assistant chief instructor will be in charge at each satellite base, and policy will be set by a central chief instructor.

During the review of Part 61, it was pointed out that the current wording of the rule, regarding gliders implies that glider pilots must be familiar with both ground and aero-tow procedures, even though ground launches are used at relatively few glider sites nationwide. Accordingly the wording was changed to include "ground and/or aero-tow procedures as appropriate."

A soon-to-be issued Notice of Proposed Rulemaking (NPRM) would create a new Part 142 (Training Centers) in the Federal Aviation Regulations. The proposed Part 142 would increase the use of flight simulators and flight training devices by persons other than air carrier certificate holders, and would reduce the number of exemptions now required to use flight simulators and other flight training devices.

The purpose of these proposed Part 61 and 141 amendments and the Part 142 NPRM is to recognize the advanced state-of-the-art in flight simulators; to make the necessary regulatory changes needed to expand the use of flight simulators in airman certification, training, testing, and checking; and to provide for the certification and operation of training centers.

The NPRM also discusses pilot requirements for Category III instrument approach operations and the co-existence of Part 142 Training Centers with Part 141 Pilot Schools. FAA will decide, following publication of this notice and adequate public comment, whether Part 141 Pilot Schools should be certificated under Part 142.

The regulatory review's second phase rulemaking foundation was completed in March 1989. The job task analysis provided a detailed look at pilots and flight instructors knowledge and ability requirements for flying all types of aircraft. The experts studied issues concerning pilot and flight instructor certificates and ratings, training and testing requirements, instructor duties and qualifications, and the possibility of combining FAR Parts 61, 141, and 143 into a single regulation.

The FAA is now considering how to make the regulations pertinent to today's flight environment. The challenge is to make the regulations flexible enough to ensure pilot and instructor training and certification requirements keep pace with aviation's changing demands.

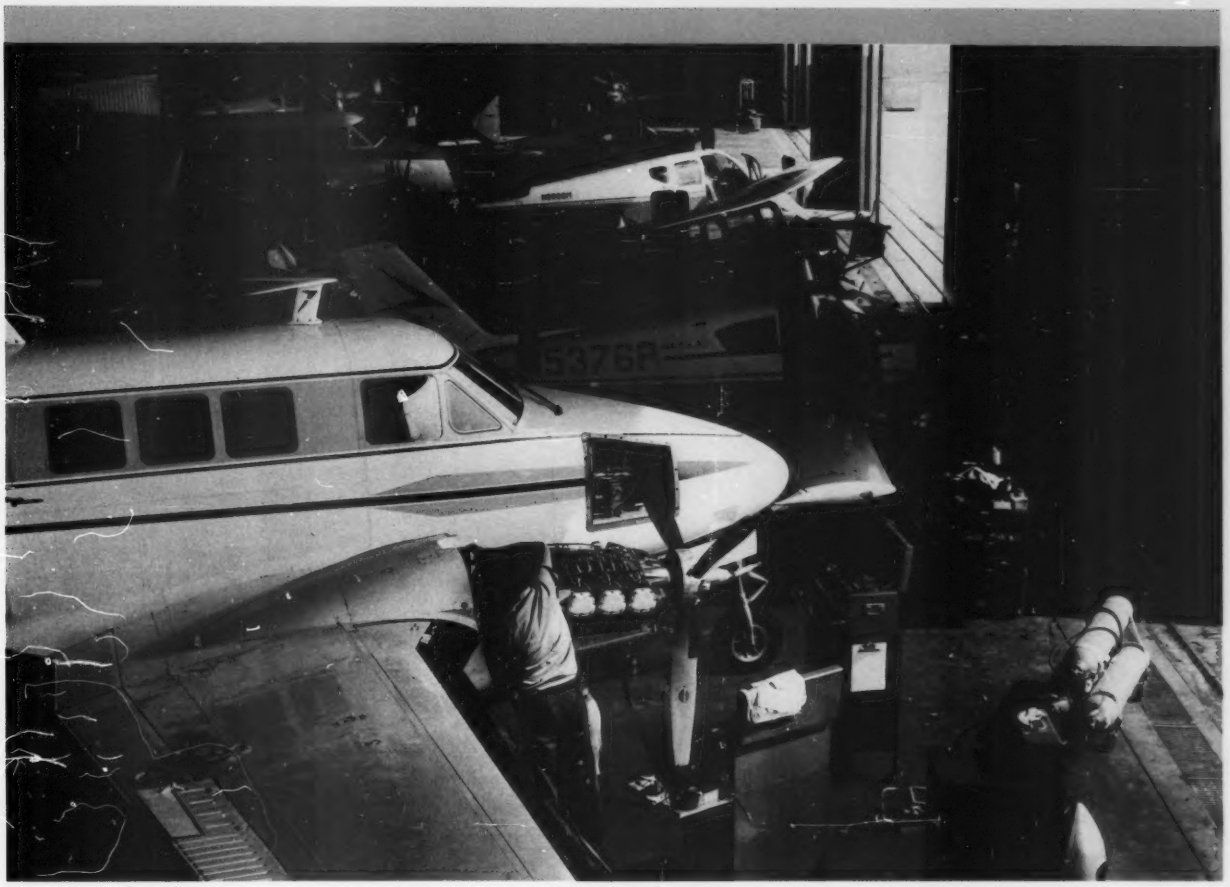
One of the positive changes in aviation during the last decade is the constant decrease in the accident rate. A goal of the regulatory review is to ensure the quality of training continues that trend. The FAA's role in this effort is multifaceted. It must develop the new initiatives and approaches to airman education and training and manage the National Airspace System while ensuring an adequate regulatory environment.

The FAA cannot accomplish this task alone. Everyone—the aviation community, educators, and other interested parties—must work with the FAA to ensure that any changes to the training and certification regulations will continue to improve the safety record of aviation in the U.S. ■

Editor's Note: This article is based on material provided by John Lynch, Aviation Safety Inspector, AFS-850.

For further information regarding the final amendments to Parts 61 and 141, and the Notice of Proposed Rulemaking for Part 142, contact FAA, Regulations Branch, AFS-850, 800 Independence Avenue, SW, Washington, DC 20591. Telephone (202) 267-8150.

The Crisis in Aviation Maintenance



Aviation is experiencing a shortage of skilled aircraft maintenance personnel to repair not only older aircraft, but also the latest high-tech avionics, engines, and equipment found in today's aircraft.

During the past decade aviation activity has increased slightly, but the supply of aircraft maintenance technicians from all quarters, including the military, has declined. Older, ex-military technicians have retired or will soon retire, and the military training of new technicians is often too specialized to serve the needs of civil aviation. Many aviation technicians have decided to seek jobs in other disciplines, where the pay is higher and working conditions better.

Because of these and other factors, the FAA is re-evaluating the methods it uses to oversee the training and certification of airframe and powerplant mechanics. It is doing so through a regulatory review of FAR Parts 65 (Certification: Airmen Other than Flight Crewmembers) and 147 (Aviation Maintenance Technician Schools).

Part 65 is the basis for certification of airframe and powerplant mechanics. Written in the early 1960's, it has not been substantially revised in more than 20 years. The FAA is evaluating potential changes to upgrade the standards. However, because this regulation affects every mechanic, any rule changes would necessitate changes in other regulations. As a result, the FAA proposes to develop a complete job task analysis of the aviation mechanic's occupation in order to determine what knowledge, skills, and abilities are required. In addition, the FAA must determine what type of post-certification training could or should be required for various specialty occupations within the industry.

Following the job task analysis, FAA plans public hearings to solicit comments on the proposed changes.

Part 147 contains the requirements for the training of aviation maintenance technicians in schools. It is based on an FAA-sponsored aviation maintenance job task analysis conducted in the mid-1960's. Named after the principal investigator, David Allen of the University of California, the Allen Study was used to develop curricula for the aviation maintenance technician schools. The concept of a job task analysis for developing training curricula was significantly ahead of its time in the 1960's.

Recognizing the need for change and responding to both the public's comments and its own inspection findings, FAA has held public listening sessions and received input from all sectors of the aviation industry. As a result, FAA is re-evaluating its operating rules and curricula for schools. FAA intends to reduce or eliminate obsolete courses and add new courses in electronics, nondestructive testing, and composite materials to meet current industry needs.

It is the FAA's intention that students be trained in state-of-the-art maintenance technologies. By improving the quality of student training, the FAA hopes to increase the quantity of maintenance technicians. ■

Editor's Note: This article is based on material provided by Leslie Vipond, Aircraft Maintenance Division, Flight Standards Service, AFS-300.

...And They Never Got Off the Ground

The Future Role of Flight Simulators in Flight Training

Photo courtesy of FlightSafety International

As discussed throughout this special training issue the use of flight simulation in airman training will become even more important in the future. This importance will be highlighted in a notice of proposed rulemaking (NPRM) to be released early in 1991. The NPRM would establish a new Federal Aviation Regulation, Part 142, to expand the use of flight simulators in pilot training by establishing the concept of flight simulator training centers.

The proposed rule would establish the training centers much like current Part 141 flight schools. An optional concept is also presented which would combine the two operations. The objective of the proposal is to provide non-Part 121 operators the benefits of advanced simulator technology in pilot training. To support the concept the proposed changes to Part 61 involve the training requirements for various pilot ratings and operations, including allowing the expanded use of simulator hours in meeting minimum flight hour requirements for the various ratings. But the key to the new proposal is the training center requirements to use both an FAA approved training program and certified simulators and/or training devices.

Years ago, the FAA had to establish a unit to both set simulator standards and to ensure operator compliance. When the FAA adopted in 1980 the then bold approach to the use of simulators, called the Advanced Simulation Plan, it based its decision on simulators faithfully and completely representing the respective airplane being simulated. The plan offered air carriers the opportunity for substantially increased training and checking authorizations in airplane simulators after they upgraded their existing simulation capability to meet more demanding FAA criteria and by providing data to support simulator evaluations. As a result, FAA granted air carriers an unprecedented level of training and checking authorization, including complete qualification of airline pilots using only the simulator—known as "zero flight time" training.

But to support the Advanced Simulation Plan, and to ensure the fast-evolving simulators met appropriate criteria, the FAA had to develop the National Simulator Program (NSP). As part of the program, a National Simulator Evaluation Team (NSET) of technical/operations specialists trained in modern simulator performance evaluation was established to ensure industry compliance with NSP directives.

Once the Atlanta-based NSP team of supervisors, aerospace engineers, and technical/operations specialists established and published the criteria for simulators and their operation, the team developed standards for each level of simulator or training device. Two advisory circulars (AC 120-40B and AC 120-45A) define the various levels of FAA approved simulators and training devices currently being used.

Today, the NSP team continues to work with simulator operators and manufacturers, as well as aircraft operators and manufacturers, to develop useful guidance information and advisory documents for simulator development and operation. This work not only facilitates the evaluation of simulation devices, but it also provides a basis for ensuring that the devices actually do replicate the look, the performance, and the "feel" of the simulated aircraft required under current and proposed training regulations. Their work will become even more important during the coming years as simulation plays an even more significant role in pilot certification if the proposed Part 142 regulation is adopted. ■

The two advisory circulars, Airplane Simulator Qualification (AC 120-40B) and Airplane Flight Training Device Qualification (AC 120-45A) provide guidance for the evaluation and qualification of flight simulation devices used in simulator training. Both are free from the DOT, Utilization and Storage Section, M-443.2, Washington, DC 20590.

EDITOR's NOTE: This article is based on material provided by Warren Robbins, Aviation Safety Inspector, Flight Standards' Regulation Branch, AFS-850, and Ed Boothe, Manager, National Simulator Programs, ASO-205.

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The Pilot Maker
The First Practical Flight Simulator

In the early days of aviation, part of the fledgling pilot's flight training involved learning how to dismantle and then reassemble an airplane. Since that time flight training requirements have changed as dramatically as the aircraft, and extensive training is now possible without even leaving the ground. So far flight training's present and future have been discussed in the preceding articles. Now let's take a nostalgic look at the past and the first practical flight simulator.

Edwin Link had begun tinkering with the idea of a flight simulator soon after he learned to fly in the mid-1920's. He argued that the cost could be driven down within the grasp of the average man—provided there was some way to fly without leaving the ground. By 1929 he proved his theory was correct.

Using the woodworking skills learned in his father's piano factory in Binghamton, NY, the 25-year old Ed Link handcrafted his first trainer, dubbed the "Pilot Maker." Although Link had no trouble demonstrating the workability of his flight simulator—he taught his brother, George, to fly with only 42 minutes of actual aircraft flight time, following a concentrated course in the "Pilot Maker"—he had no cash buyers for the machine. So during those lean days of the early Depression years, he operated a small pilot training school, repaired aircraft, and did odd jobs to make ends meet.

Using his "Pilot Maker" in his own flying school, Link was able to turn out qualified pilots for $85, about one-tenth of the going rate of $25 to $50 per hour. Still the trainer did not sell and Link continued trying to scratch a living out of aviation. He added airport manager, charter pilot, barnstormer, and air show impresario to his resume. He invented an illuminated aerial sign and began contracting for commercial advertising in the sky. The "fly-by-night" advertising venture prospered and became the mainstay in Link's struggling aviation enterprise. It also produced an unexpected dividend. He became an expert at night and instrument flight out of necessity—a fact that would later work to his advantage.

A low ceiling had closed in Newark Airport on the morning of February 20, 1934, as fog swirled in from the New Jersey marshes. Inside the frigid, dimly lit Newark hangar Brigadier General Oscar

(continued on page 16)

New Approaches

AQP and ISD

The technology explosion in aviation has taken many by surprise. The FAA has been one of the first to regroup and encourage new approaches to the training of airmen based on the ever-changing technological advances. One of the first new approaches to training is the Advanced Qualification Program, better known as AQP.

The intent of AQP is to ensure that airlines and training centers can improve their operational personnel proficiency through better training, thereby improving safety overall. By using the latest training technology, such as Cockpit Resource Management and Line Operational Simulations (explained in next article), and by using a structured, systematic process to develop, implement, operate, and maintain training programs, the airlines and training centers will produce better trained crews using the AQP.

AQP is such an important new approach to training airmen that FAA decided to "institutionalize" it in a Special Federal Aviation Regulation, SFAR 58. SFAR 58 and a companion advisory circular (both entitled Advanced Qualification Program) provide guidance for the AQP process. The guidance explains how operators can apply for AQP approval, and it explains AQP's five sequential phases. These phases, from Initial Application to Final Continuing Operations, reflect contemporary personnel management business practices. The advisory circular guidance also discusses Cockpit Resource Management and Line Operations Simulation.

Current requirements provide for periodic training for individual crewmembers in an artificial setting that often does not reflect actual flight events and without evaluation and/or proficiency checks. AQP will require operators to train a complete cockpit crew as a unit. The crew will be trained using realistic flight scenarios, and more importantly, they will be evaluated immediately after the training. FAA expects that training and checking in a (simulated) well-developed, line operational, full crew environment, as opposed to the random events for individual crewmembers used in contemporary programs, will improve both crew proficiency and safety.

AQP provides for more effective training that will raise professional qualifications to a level above current standards specified in FAR Parts 121, 125, and 135. This increase in effectiveness should be accomplished without unduly increasing the training costs.

When an airline or training center elects to implement AQP as published in SFAR 58, the following become mandatory in their training programs: cockpit resource management (CRM), line oriented flight training (LOFT) and evaluation, improved instructor/evaluator training, and greater use of a crew concept for training and qualification sessions.

When an air carrier elects to apply for AQP, or some other innovative form of training, that carrier must use a systematic approach to training. This can be accomplished by using a systematic approach to training called Instructional System Development (ISD). Design and development of any training product—a formal classroom course, computer software, or a paper job aid—can be done best by using the ISD process. ISD gets training products and programs analyzed, designed, developed, implemented, and evaluated. ISD involves the following five-stage, systematic approach to training.

• **Analysis.** The first stage of ISD requires a great deal of effort to collect and analyze jobs, tasks, and documents, prepare job descriptions, and make a variety of highly important training decisions. If this stage is done well, the training provided will be consistent with the tasks performed on the job. If the analysis is done poorly, unnecessary training, or worse, no training at all, could result.

to Airmen Training

• **Design.** After analyzing existing jobs, tasks, courses, and products, and selecting instructional settings, the training designer begins the second stage of ISD—the training product's design—by creating objectives and tests.

The design describes job behavior at the entry level, provides the sequence and structure of the training, and specifies learning events and activities. Based on the training objectives, the designer determines appropriate training delivery methods (e.g., lectures, small group work, role-playing, or computer-based instruction) and media (e.g., video tapes, software, printed materials, or audio cassettes).

• **Development.** The development stage of the ISD model is one of the most important in the entire training process. This is the point where the training designer produces the actual training products and/or acquires specific training methods and media. The product of this stage is the completed instructional program that includes all revised and developed materials as well as concise instructions for using the program.

• **Implementation.** Fourth is the implementation stage. As the result of a prototype presentation of the training, the designer determines if the instructional program works the way it was designed. If it does not, this is where the designer revises the program until the participants can meet the learning objectives. However, from a practical point of view, it is almost impossible to design and present instructional material that will provide solutions to all possible problems.

• **Evaluation.** During the fifth phase of ISD, the designer conducts evaluation (i.e., the designer measures the effectiveness of the training) to determine whether the training has accomplished what was intended. All good training designers use careful research, measurement, and evaluation to revise and improve training. Follow-on evaluations with their inevitable revisions ensure training remains current.

The ISD process never ends. It is a continuous process where training is constantly being analyzed, designed, developed, presented, evaluated, and revised to enhance aviation safety. ■

EDITOR'S NOTE: This article is based on technical papers prepared by Ruth Ann Hodges, Instructional Systems Design Specialist, AFS-210, and Jan Demuth, Aviation Safety Inspector, AFS-210. If you desire additional information on these subject areas, contact Ms. Hodges or Mr. Demuth for copies of those technical papers by writing FAA, Air Carrier Training Branch, AFS-210, 800 Independence Ave., SW, Washington, DC 20591.

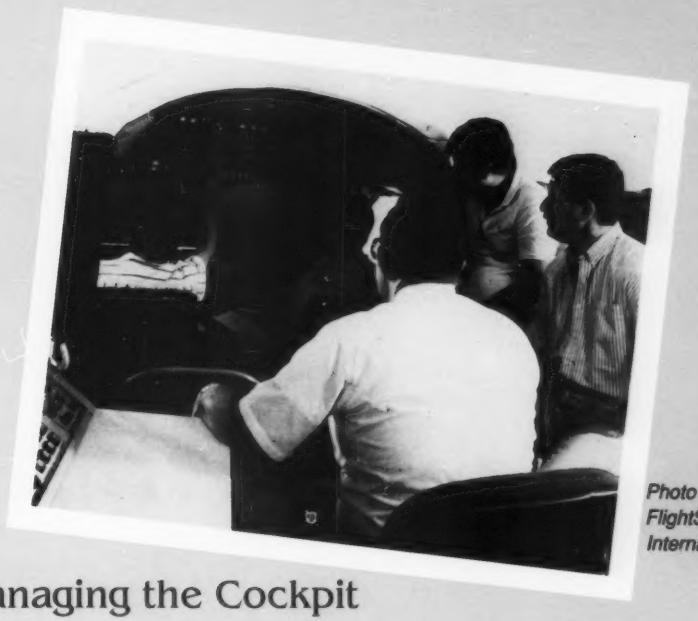


Photo courtesy of FlightSafety International

Managing the Cockpit

Cockpit Resource Management (CRM) is a training concept concerned in part with how well cockpit crewmembers work together as a team. Although primarily associated with air carriers, it is also being used in general aviation. Pilots, who take the time to discuss how to share flying duties on a cross-country flight, or flight instructors, who establish a clearly understood procedure for sharing flight responsibilities during instruction, are practicing a form of CRM.

Evidence since 1979 suggests that 70 percent of air carrier incidents and accidents are caused, at least in part, by failure of the flight crew to work together effectively. Studies show problems encountered by flight crews often have little to do with technical aspects of operating an aircraft. Instead, the problems are associated with poor decision-making, problem-solving, and judgement; ineffective communication; poor situational awareness; inadequate stress and team management; and little team review.

For years, air carriers concentrated aircrew training efforts on the technical aspects of flying. Pilots were trained to operate their aircraft with precision, but they were not trained in interpersonal communications and cockpit management skills. The importance of these skills is demonstrated by an accident that occurred in 1979 when an aircraft ran out of fuel while the flight crew concentrated on analyzing a minor landing gear malfunction. The aircraft overflew the intended landing airport three times while the flight engineer reminded the captain numerous times that their fuel was dangerously low. Because of poor cockpit management, the aircraft crashed.

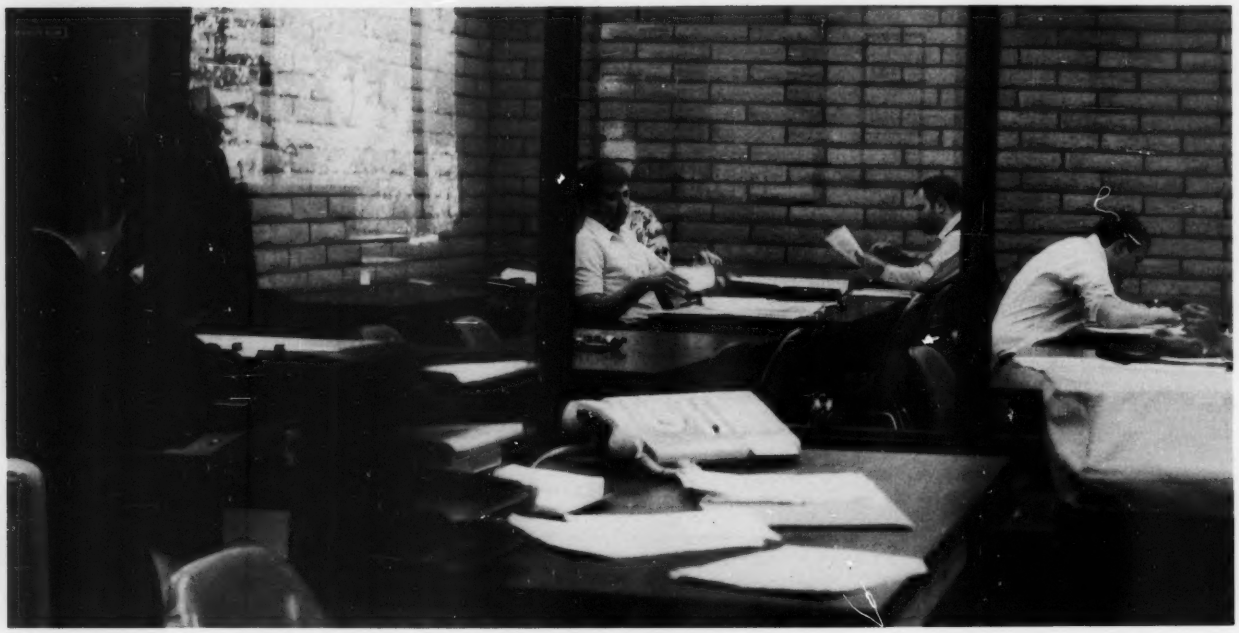
Today, many air carriers are using CRM training courses. Typically, the training includes an awareness phase to introduce CRM concepts, a practice and feedback phase to gain experience using CRM techniques, and a reinforcement phase where CRM principles are addressed on a long-term basis.

One of the best methods to learn, practice, and develop CRM skills is through the use of Line Oriented Flight Training (LOFT). LOFT is training conducted in a high-fidelity flight simulator with complete flight crews using representative, real-time flights that incorporate normal, abnormal, and emergency operations. Flight crews participating in LOFT do not receive grades as they conduct a simulated flight the way they would during actual operations. The purpose of the training is to allow flight crews to develop and learn competent flight skills and how to work effectively together as abnormal and emergency situations are presented, rather than to earn a grade.

The days of the autocratic captain and passive first and second officers are over. As flight crews become as knowledgeable of CRM skills as they are of aircraft flight skills, there should be an appreciable decline in aviation mishap rates. ■

EDITOR'S NOTE: This article is based on material provided by Tom Toula, Aviation Safety Inspector, Flight Standards' Air Carrier Training Branch, AFS-210.

After the Training Is Over



Within FAA's Aviation Standards National Field Office at the Mike Monroney Aeronautical Center in Oklahoma City, OK, is the Operations Standards Development Section (AVN-131). It is involved in all aspects of airman certification, and all U.S. certificated pilots, ranging from the newly certificated recreational pilot to the veteran airline captain, have met the standards set forth by this unit. It develops 170 airman certification written tests per year and is also responsible for all airmen flight tests and educational material. Its airman certification standards and policies affect the aviation community worldwide.

The present organization consists of 13 FAA volunteers who are interested in education in general and flying in particular. All are rated pilots, averaging 5,000 hours experience. Most have had extensive flight instructor experience, ranging from industry to the FAA academy to military contract flight schools. Some are ex-military pilots and ex-military instructor pilots, while others have had long-term involvement in general aviation flight training, having owned and operated fixed-base operations with flight schools.

AVN-131 is organized into "certification" and "program" areas. Each certification area is managed by an aviation safety inspector who is a certification specialist. The certification areas are: Recreational and Private Pilot, Commercial Pilot, Instrument Rating, Airline Transport Pilot, Flight Engineer, and Flight Instructor.

Certification area managers are responsible for assuring that written and practical tests within their area of responsibility are valid and accurately measure knowledge and skills required for certification. Each manager is also responsible for quality control of the written and practical tests, including responding to inquiries and criticism within their respective areas. They also review each written test and test item for validity and develop new written tests annually. (Practical test standards are updated on an "as needed" basis.)

To remain up to date in aviation matters, each manager is required to remain current as a pilot in all category and classes of aircraft on his/her pilot certificates, except airship. While using FAA aircraft and civil rental aircraft to keep current, they also utilize this flight time by evaluating various practical test standards, specific tasks, test timing, and by keeping current with ATC procedures. In addition, the flight evaluation program is used to aid in developing and revising aviation educational manuals, such as the Pilot's Handbook of Aeronautical Knowledge, AC 61-23; the Flight Training Handbook, AC 61-21; the Instrument Flying Handbook, AC 61-27; the Basic Helicopter Handbook, AC 61-13; and the Aviation Instructor's Handbook, AC 60-14. (All are for sale at the Superintendent of Documents, U.S. GPO. Call 202-783-3238 for current price information.)

The Operations Standards Development Section also manages a number of certification-related programs, the newest of which is the Computer Assisted Airmen Knowledge Test Program. The manager of this program is responsible for over 60 privately owned, nationwide testing centers that administer airman written knowledge tests by computer. Specifically, this manager establishes and monitors a record system for each test area, analyzes each test and test item for validity, records test analysis, develops educational data for public consumption, responds to public and FAA inquiries, and inspects several testing centers annually to ensure compliance with FAA regulations.

Members of AVN-131 also participate in public hearings, industry and college seminars, and, when called upon, help write notices of proposed rulemaking and FAR.

The work in AVN-131 is interesting, demanding, difficult to manage at times, but always self-satisfying. The section expends a constant effort in reviewing, revising, and analyzing all aspects of training and in the evaluation of training to help improve flight safety throughout the world. ■

COMPUTER ASSISTED AIRMEN KNOWLEDGE TESTING PROGRAM

Another example of the FAA's concern with improving airmen's testing procedures is though the use of computerized testing. The prototype Computer Assisted Airmen Knowledge Testing Program has been online since November 1989. It is a computerized written test program that not only has the ability to enhance the evaluation of airman knowledge, but it also can provide immediate test results after the applicant completes the test. Quick test results and feedback provide timely data for both the applicant and the instructor so they can evaluate the training process. The testing program provides the capability for questions to be quickly updated to reflect regulatory changes or to meet other new requirements. The system also provides data for educational and statistical purposes.

Airmen can take the computerized written tests and receive the instant results at over 60 Plato Professional Development Center locations across the country. Anyone interested in the program can obtain additional information from Advisory Circular 61-102 (free from the DOT, Utilization and Storage Section, M-443.2, Washington, DC 20590) or by calling 1-800-869-1100 for information and the location of the nearest test center.

Some people perceive training as an end in itself rather than as a means to an end. Flight training is no different. Many people consider the important part of training the training itself. For, although flight training provides an airman applicant with the required knowledge and skills to qualify for a certificate or rating, completing the required training is not the end. Rather, it is just the beginning, for when the specific training is completed, the FAA tests the applicant to determine how well the training has been mastered.

The FAA tests airman knowledge through a written testing program, given either at FAA offices or by designated written test examiners. FAA inspectors or designated pilot examiners test airman skills through practical tests where the applicant must prove proficiency in either an aircraft or simulator. The tests also validate the training program's effectiveness. Obviously, high failure rates among otherwise average applicants may indicate a fault in training and the need for revising the course. One result of this concern for the quality of airmen training and testing was the FAA's development of the Airmen Practical Test Standards used today.

In the early 1980's FAA recognized the advisory circular flight test guides used to test airman applicants for certificates or ratings had several deficiencies, mostly related to new equipment and operational techniques. They were in dire need of upgrading, updating, and replacement.

Rising to the challenge, a development team from FAA's Aviation Standards National Field Office in Oklahoma City began work on a prototype Practical Test Standard (PTS) for private pilot certification. They conducted research to determine what knowledge and skill areas were applicable to private pilot certification and for added ratings in airplanes, rotorcraft, gliders, and lighter-than-air vehicles. The development of valid areas of operation, tasks, and performance standards was based on this study. Various FAA segments, industry groups, and flight schools all contributed to the prototype's development.

In developing the new PTS, the team made a major effort to correct recognized deficiencies in the flight test guides. A great deal of insight into the deficiencies came from files kept on examiner and inspector comments about the guides' use. The Pilot Examiner Standardization Branch also provided valuable information on just what examiners were looking for in the way of test guidance. The overall goal of the PTS project was to create a pilot proficiency evaluation instrument that could be used by FAA inspectors and designated examiners in a standard, fair, and consistent manner to evaluate pilot knowledge and skill. A collateral goal was to provide flight instructors with clear, concrete guidance about required FAA pilot proficiency standards.

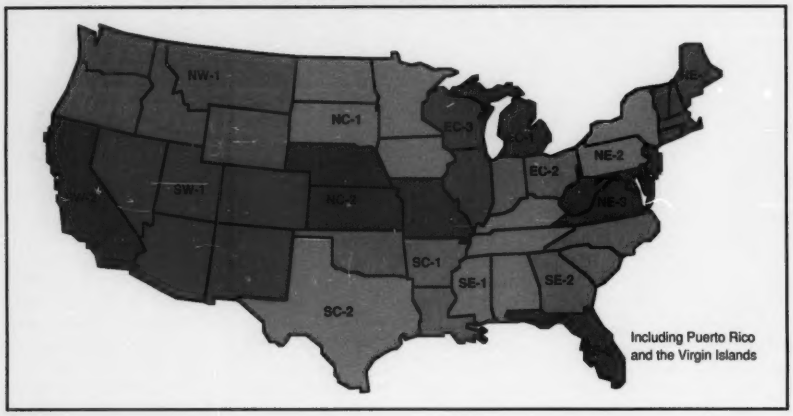
In 1984 the prototype Private Pilot Practical Test Standards was published and made available to the public through the U.S. Government Printing Office (GPO). Work began immediately on the Commercial PTS, the Instrument Rating PTS, the Flight Instructor PTS, the Airline Transport Pilot PTS, the Aircraft Dispatcher PTS, and the Recreational Pilot PTS. All PTS have been published and are available for purchase from GPO. (Call the GPO Order Desk at 202-783-3238 for current price information.)

The switch from the pamphlet-sized flight test guides to the book-sized PTS took some getting accustomed to, but once they came into wide use, the aviation public, particularly instructors, welcomed them. Flight instructors have commented that the standards have greatly improved the quality of flight instruction and that proficiency requirements, previously rather vague, are now clear. Furthermore, the detailed elements and common errors included in the PTS are particularly useful during the course of student pilot training.

Six years after their initial introduction, the Practical Test Standards have had a very positive impact on the quality of both the training and the evaluation of students for pilot certificates and ratings. ■

EDITOR'S NOTE: Based on material provided by Gary Walker, Operations Support Branch, AVN-131.

U.S. TERMINAL PUBLICATION VOLUMES



NEW TERMINAL PROCEDURES PUBLICATION

A new publication, called the U.S. Terminal Procedures Publication (TPP), will consolidate by airport the Instrument Approach Procedures (IAP) Charts with the Standard Instrument Departures (SID) Charts. Also, the Standard Terminal Arrival (STAR) volumes will be grouped at the front of each volume. The individual IAP, SID, and STAR volumes will be discontinued when the TPP goes into effect on December 13, 1990.

Other features of the new publication will be a table of contents on the cover of each volume, alternate and takeoff minimums will be referenced in the index, and supplemental pages will be identified for quick reference. The TPP will be published every 56 days and will consist of 16 volumes with a single Change Notice at the 28 day midpoint. (Map shows TPP area of coverage for each volume.)

After October 18, subscribers to SID and STAR Charts will receive a refund for the remaining portion of their subscriptions. Subscribers to the IAP volumes will receive comparable TPP volumes or a combination of TPP volumes that will provide the same coverage. The additional volumes will be provided free of charge until the IAP subscription expires.

For subscription information on the TPP contact NOAA, National Ocean Service, Distribution Branch (N/CG 33), 6501 Lafayette Ave., Riverdale, MD 20737. Telephone 301-436-6990.

DATA RECORDING REQUIREMENT UPDATE

The last issue of *FAA Aviation News* announced that the Federal Aviation Regulations have been amended to require digital flight data recorders and cockpit voice recorders to be installed in a broad category of airplanes and rotorcraft operated by air carriers and commuter airlines, as well as in selected general aviation aircraft. The amendments are expected to provide more information to accident investigators and to help determine measures needed to prevent accidents. However, the following two paragraphs were inadvertently left out, which could have a serious impact on those aircraft involved.

> "Although the compliance date for cockpit voice recorders installation is October 11, 1991, current information indicates a potential for a last minute rush. In April 1988 the number of cockpit voice recorder installations required to meet the 1991 compliance date was estimated to be 250 per month—the number has now increased to 350.
>
> "The FAA does NOT plan to extend the compliance data and last minute installation scheduling could lead to extended down time and increased installation costs. Recorder manufacturers and installation agencies are presently not geared to meet short term needs and require longer lead time to manufacture recorders and to accomplish installations. Persons whose aircraft are required to comply with the new recorder equipment requirements are urged to schedule the recorder purchase and installation now with an aircraft alteration facility."

For further information contact Mr. Frank Rock, FAA, AIR-120, 800 Independence Ave., SW, Washington, DC 20591. Telephone (202) 267-9567.

OBJECTS AFFECTING NAVIGABLE AIRSPACE

The FAA is proposing changes to FAR Part 77, "Objects Affecting Navigable Airspace." Several areas addressed in the NPRM include language about electromagnetic interference (EMI) that could create a hazard to air navigation, a requirement for the FAA to consider the "cumulative impact" of proposed construction when combined with existing or future projects, certain National Airspace Review Advisory Committee recommendations to simplify and clarify existing regulations, and the cancellation of two subparts of the FAR, one dealing with antenna farms and the other dealing with hearings.

Copies of the NPRM, Docket No. 26305, Notice No. 90-18, can be requested from the Federal Aviation Administration, Office of Public Affairs, Attention: Public Inquiry Center, APA-430, 800 Independence Ave., SW, Washington, DC 20591.

Public comments about the NPRM must be submitted in triplicate to the FAA no later than Dec. 31, 1990. Comments should be sent to Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. 26305, 800 Independence Ave., SW, Washington, DC 20591 or delivered to Room 915-G at the above address. Submitted comments may be reviewed in the Rules Docket at FAA during working hours from 8:30 am to 5 pm.

TCA NAV RULE EASED

As of July 18, 1990, FAA no longer requires aircraft operating under Visual Flight Rules (VFR) in a Terminal Control Area (TCA) to be equipped with VOR or TACAN navigational equipment. The amendment affects FAR §91.131 (old FAR §91.90).

For additional information contact Mr. Bill Davis, FAA, ATP-230, 800 Independence Ave., SW, Washington, DC 20591. Telephone 202-267-8783.

NEW PART 91 MEL POLICY

New FAR Part 91.213 minimum equipment list (MEL) approval policy is in effect. Designed to speed up the FAA's approval process, the policy's key changes include: FAA inspectors are not required to review an operator's operation and maintenance procedures prior to approving a MEL; operators have to countersign the authorization letter prior to its being issued; authorization letters will not have an expiration date; when operators relocate, they will not need a new authorization letter; and the burden of compliance is on the operator.

Operators should contact their local Flight Standards District Office for complete information about the new policy.

• AD Compliance

If an aircraft is certificated as airworthy on the basis of an annual inspection, does such a certification, by implication, also certify that all Airworthiness Directives have been complied with? If this is so, does such a certification of airworthiness absolve the owner/operator from responsibility if it is subsequently found that compliance was not, in fact, complete?

Cyril Toker
Potomac, MD

For an aircraft to be airworthy, all required AD's must be complied with and signed off at the time of the annual inspection.

The failure of a mechanic to comply with all required AD's does not absolve the owner or operator of the responsibility for ensuring compliance with every AD. FAR §91.403 (old §91.165) states, in part, the owner or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition. And §91.407 (old §91.167) states, in part, that each owner or operator shall have the aircraft inspected and between inspections have discrepancies repaired as prescribed by the appropriate FAR. It also requires the owner or operator ensure that maintenance personnel make appropriate entries in the maintenance records indicating the aircraft has been returned to service. Although the mechanic during the annual, the pilot in command flying the aircraft, and the owner/operator share varying degrees of responsibility for ensuring the airworthiness of an aircraft before, during, and after flight, the owner/operator is ultimately responsible.

• Mt. Redoubt Correction

Pappy Slagle, ENA AFSS, Kenai, Alaska, sent in the following correction regarding the May/June 90 story "ASH FALLOUT" concerning volcanic ash from Mt. Redoubt in Alaska. The story gave the center of the flight restriction as Anchorage instead of Mt. Redoubt. The correct location is a 10-mile radius circle centered on Mt. Redoubt at coordinates 60-29N, 152-45W, or 84 nautical miles from the Anchorage VOR on the 217 degree radial.

Bob Paxton, Anchorage ARTCC, reminds pilots not to fly into an ash cloud. He said a KLM B747 lost power in all four engines after flying into an ash cloud in December 1989. Repairs cost more than $60 million.

Thanks for the info.

• Traffic Pattern in CZ

I find myself in disagreement with fellow flight instructors on the subject of traffic pattern altitudes in a control zone, so maybe you can help. Here is the situation:

The weather from ATIS is 1,000' overcast and five miles visibility. You are about to conduct a pattern-only instructional flight at a tower-controlled airport, where there is a control zone and an associated transition area. The question is, what is the maximum traffic pattern altitude for this scenario?

Other instructors have argued that if they entered the traffic pattern via a transition area they could legally be as high as 699' AGL (just under the floor of the transition area). They say that since the airport has VFR conditions, the control zone is no longer in effect, and that weather minimums would simply be "clear of clouds." They also point out that the airport traffic area is not controlled airspace.

I believe that you could not legally fly in the pattern higher than 500' AGL, in order to maintain a 500' separation from the overcast. Who is correct?

Phillip L. Martin
Terre Haute, IN

Control zones are regulatory and exist continuously, unless otherwise specifically limited by the regulation which established them. Therefore, to operate VFR in the control zone conditions you describe, you would have to maintain the required 500' below/1,000' above/2,000' horizontal separation from clouds, plus three miles visibility.

Note that FAA does not establish "legal" airport traffic patterns or pattern altitudes, although the agency does recommend observance of locally established patterns, as feasible. Also, while an airport traffic area is not designated controlled airspace in FAR Part 71, when it co-exists within an "active" control zone, that airspace is considered controlled airspace for the purposes of communication and ATC procedures.

• ATA Weather

With the air of determining which visibility minimums and cloud separation criteria should be applied as per FAR §91.105, I would like the following question answered. Is an airport traffic area controlled or uncontrolled airspace? Please answer with regard to the ATA only. Assume there is no CZ co-located or in effect and there is no ARSA, TCA, or CA present either.

I contend that as per the definition of controlled airspace in FAR Part 1, FAR §91.87 and the AIM paragraphs 90 through 100 and 130, although the ATA is most certainly regulated airspace in which certain operating procedures and restrictions are set forth, it is not defined anywhere as controlled airspace. Therefore, the criteria in FAR §91.105 for uncontrolled airspace apply in the absence of any other airspace which is defined as controlled being co-located with it.

John Goldfluss
New Windsor, NY

We agree that an airport traffic area, unless co-located with some form of controlled airspace, is subject to the weather minimums for uncontrolled airspace. Pilots intending to enter an ATA are subject to all the provisions of FAR §91.129 (old Part §91.87), "Operations at Airports with Operating Control Towers." ATA airspace is defined as unless otherwise specifically designated in FAR Part 93 that airspace within a horizontal radius of five statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

FAA AVIATION NEWS welcomes comments from our readers. Letters may be edited for style and length. No anonymous letters will be used, but names will be withheld on request. Address: FAA AVIATION NEWS, AFS-20, Washington, DC 20591.

• Timing at Holding Fixes

In describing timing procedures in a holding pattern, the Airman's Information Manual says that the "Outbound leg timing begins over/abeam the fix, whichever occurs later."

Under what circumstances would you find yourself starting to time the outbound leg at the holding fix? That is, when would "over" the fix occur later than "abeam" the fix?

James M. Thoburn
Rochester, NY

Paragraph 347 of the AIM states "Outbound leg timing begins over/abeam the fix, whichever occurs later. If the abeam position cannot be determined, start timing when turn to outbound is completed." Examples would be holding at a VOR intersection or at an ILS outer marker.

INSTRUMENT CORNER

• Instrument Training PIC Time

Who logs pilot in command time while receiving or giving instrument training instruction. Does it make any difference if the training flight is in instrument meteorological conditions or under simulated instrument conditions?

T. Black
Lenexa, KS

FAR §61.51, Pilot Logbooks, addresses the logging of flight time. An instrument student with a recreational or higher pilot certificate receiving instrument instruction may log the time as pilot in command during the time he or she is the sole manipulator of the controls of an aircraft for which he or she is rated. Under Part §61.51(c)(2)(iii), the flight instructor may log as PIC time that time he or she is acting as a flight instructor. The above rules apply regardless of the meteorological conditions. However, when operating under actual IMC, the flight instructor must be pilot in command under Part 1 of the FAR's and may under Part §61.51(c)(4) log the time during which he or she is giving instruction as instrument time for currency purposes.

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Famous **FLIGHTS** *(continued from page 9)*

Westover and his staff of military and civilian aircraft technicians were gaping at the oddest looking "aircraft" they had ever seen. The inventor of this "Pilot Maker," Edwin A. Link, had promised to fly down from his small flying school and factory in Cortland, NY, to demonstrate how his odd-looking invention could save the Air Corps precious hours of training time.

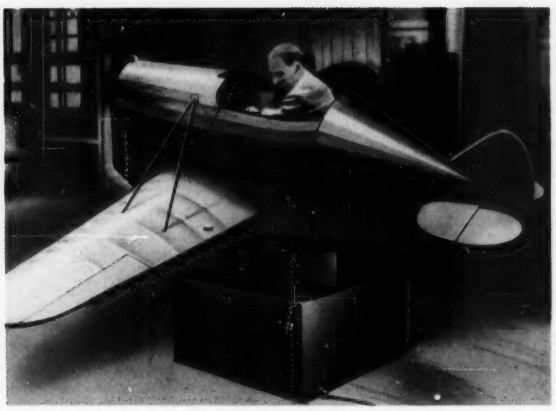
Link had been trying to sell his invention to the Air Corps for several years, but no one in the War Department was willing to pay good American cash for an airplane that was not supposed to leave the ground. However, the Army now had a crisis on its hands. The Air Mail Service had been abruptly militarized by President Franklin D. Roosevelt and, although the Army Air Corps had the personnel, they lacked the necessary flying expertise. On the first day the Army flew the mail, it suffered three fatalities and one gravely injured pilot. Of the 200 Air Corps pilots assigned to fly the mail, only two had more than 50 hours of flight time.

While there were exceptions, the average Air Corps pilot had only five hours of simulated instrument time and none at all under actual instrument flight conditions. Also, few pilots could operate the crude radios of the day, and there were only a few scattered ground radio stations. All of the accidents involved weather, and the problem was sadly clear: How could pilots unfamiliar with instrument flight learn to fly in all kinds of weather overnight? The situation was desperate, which provided Link with interested, if still skeptical, listeners.

The weather worsened as the morning wore on and General Westover and his staff, convinced that Link could never penetrate the fog surrounding the airport, debated about returning to Washington. Suddenly they heard a plane circling the field. The officers rushed outside and caught glimpses of a Cessna as it broke out of a 300 foot ceiling.

Newark Airport had one of the few experimental "four-legged" radio courses in the country, and Link, with the aid of his few cockpit instruments, had been able to pick up the beam and follow it to Newark.

In reply to the question from the Air Corps group, "How did you ever do it?" he pointed to his clumsy-looking "Pilot Maker" and proceeded to demonstrate how it could teach a pilot to rely on instruments rather than the seat of his pants.



First Link Trainer about 1928

Miniature wings and tail surfaces sprouted from a stubby fuselage and the unit was mounted on a pneumatic bellows which not only permitted it to move in a full 360° horizontal plane, but also to yaw, pitch and roll. The cockpit, which could be completely covered by a domed hatch to cut the pilot off from all outside visual references, contained flight controls and a panel equipped with airspeed indicator, compass, turn and bank indicator, and barometric altimeter. Pressure on the stick or rudder pedals would cause the "aircraft" to respond like a real plane. Mishandled, it could even "crash."

General Westover promptly contracted with Link to train ten Air Corps pilots in instrument flying, using the Link trainer for almost all of the instruction. Impressed by the all-weather flying performance of these pilots, the Air Corps soon bought six trainers at $3,500 each.

The era of the simulator was born on that foggy February morning in Newark where an aeronautical demonstration would revolutionize flight training, despite the fact that the demonstrator never left the ground. ■